



EFFECT OF RESTRICTED FEEDING PERIODS DURING LATE PREGNANCY AND EARLY LACTATION ON THE PRODUCTIVE AND REPRODUCTIVE PERFORMANCES OF THE DROMEDARY SHE –CAMEL

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ABSTRACT

The present study aimed to justify the effects of restricted feeding periods during last month of pregnancy and initiation of lactation on growth rate of Maghrebi she-camel and their offsprings. Sixteen pregnant she-camels with an average body weight 512.74 kg were divided randomly into three groups. The first group (G1) was fed 100% of their daily requirements concentrates. The second group (G2) was offered 75% of their daily requirement of concentrates after delivery for one month, while the third group (G3) was fed on 75% of their daily of concentrate requirements for two months (one month pre and another one post-partum). New born calves were divided after one month of lactation to four groups as following; calves born G1 dams were divided randomly to two subgroups. The first one (G11) suckled their dams naturally, while the other (G12) was artificial reared on a milk mixture (50% natural camel milk and 50% cattle milk replacer). Calves born to G2 and G3 dams were artificial reared on a mixture 50% natural camel milk and 50% cattle milk replacer. Results obtained showed that she-camels of G1 gained insignificant more live body weight than that of G3 during the pre-calving period 49.09 vs. 42.05 kg, respectively. There were insignificant differences among the 3 groups in calves birth weight 30.44, 32.8 and 29.73 kg, respectively. During lactation

period, she-camels of G1 produced insignificantly more daily milk in compare with the corresponding she-camels of G2 and G3 (3.78 liter vs. 3.32 and 3.4 liter/ animal), respectively. She-camel of G3 lost significantly ($P<0.05$) more LBW from the beginning of the experiment to the end of the study in compare with both of G1 and G2 she-camels. Calves of one month of age and born to G1 dams indicate faster ($P<0.05$) daily gain (0.326 kg / h/ day) than those to both of G2 and G3 dams. Three months old age calves of different groups, indicated nearly similar growth, regardless of their dams feed restriction and type of calves rearing (natural vs. artificial). Data obtained showed also that neither she-camels feed restriction practice nor type of calves rearing have any significant effect on either calves daily gain or dams final LBW after 3 months of treatments.

INTRODUCTION

The relationship between feed intake and milk production during pregnancy period of she-camel and calf birth weight are considered of practical importance in camel farming system. Indeed, the prenatal growth trajectory is sensitive to the direct and indirect effects of maternal dietary intake from the earliest stages of embryonic life, when the nutrient requirements for concept growth are negligible (Robinson *et al.*, 1995). Lodge *et al* (1975) postulated that feed restriction during pre-partum may act as a stimulant to improve feed intake after calving which would be desirable as the efficiency

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of conversion of nutrients to milk, has been shown to be better when the nutrients are directly converted to milk in a dairy cow than when they are routed through body energy reserves.

Gueroali and Wardeh (2000) referred that restricted feeding in camel at levels of 40%, 60%, 80% and 100% as dry matter of diet consists of 50% barley grain, 17% sunflower meal and 33% ground straw, the Dry matter digestibility increase in camel with the increase of level of intake. While, **Afaf, (2007)** found that feed restriction periods to (30, 60, 90 days) showed insignificantly effect on digestibility of most nutrients had happened except crude protein (CP) which was decreased by increase of the restricted period.

Therefore, the present study aimed to define the effect of restricted feeding period during late pregnancy and early lactation on productive and reproductive traits of the Maghrebi she-camels.

MATERIALS AND METHODS

1- Experimental design

Three restricted feeding periods were evaluated in this study using three groups of 16 Maghrebi she-camels. The first group (G1) received 100% of feeding requirements according to recommendations of Animal Production Research institute for pregnant and dairy camel from the beginning to the end of the experiment. She-camels in groups (G2) and (G3) were given restricted concentrate feeding rations (CFR) and *ad libitum* of roughage. She-

camels in group (G2) were given normal feeding before delivery and 75% of concentrate requirements for one month after delivery. The third group (G3) was given 75% of concentrate feeding requirements for two months, one month before and one month after delivery.

2-Experimental Animals

Sixteen pregnant Maghrebi she-camels (*Camelus dromedarus*) with average live body weight (LBW) 512.74 kg and parity (2-5) were randomly assigned according to average body live weight and parity into three groups 6 animals for G1, 5 animals for each G2 and G3. The average body weight was routinely recorded during the last three months of gestation, at the delivery and thereafter during three months of post-partum. Newborn calves of the dams groups were also weighted at birth and thereafter during 7 months post-calving.

3- Experimental rations

The experimental ration consisted of concentrate feed mixture, wheat straw and berseem hay. The concentrate feed mixture (CFM) composed of 25% wheat bran, 25% yellow corn, 9% uncorticated cotton seed meal, 20% barley, 15% rice brain, 3% molasses, 2% premix and 1% common salt. The chemical composition of CFM, rice straw and berseem hay are presented in **Table (1)**.

Table 1. Chemical compositions of the experimental rations ingredients and ration used feeding of Maghrebi she- camel during pregnancy and lactation (on dry matter basis)

Nutrients	CFM (concentrate feed mixture)	BH (berseem hay)	RS (rice straw)	Chemical composition of experimental ration
Dry matter %	90.8	92.8	89.0	90.4
Organic matter %	89.3	92.4	85.0	88.6
Crude Fiber %	13.0	30.5	44.3	27.5
Crude protein %	12.9	11.3	3.5	10.8
Ether extract %	3.6	3.2	1.7	2.7
Nitrogen free extract %	59.8	47.4	35.5	47.6
Ash %	10.7	7.6	15.0	11.4

3- Digestibility trials

Two digestibility trails were conducted. The first one was carried out at the end of the first restricted feeding period five days before delivery while, the

second trail was carried out at the end of restriction after delivery 30 days. During the digestion trail, animals were fed their daily allowance according to the experimental design assigned for each group over the feeding trail. About 200 g fecal samples

were taken during the collection period for three consecutive days. The daily samples of feces for each animal were frozen immediately after collection at -20 until the end of collection period. Composite samples were prepared and dried in a forced air oven at 60 °C for 72 hours, then ground and kept at room temperature until chemical analysis. Nutrients digestibility were determined using Acid Insoluble Ash (AIA) as internal indicator according to **Reid et al (1950)**.

$X = 100 - 100$ (Percent of indicator in feed ÷ percent of nutrient in feed) × (Percent of nutrients in feces ÷ Percent of indicator in feces), where X: equal nutrient digestibility.

4. Chemical analysis

Feed and feces were prepared for proximate analysis according to **A.O.A.C (1990)**. Acid insoluble Ash (AIA) was analyzed according to **Van Keulen and Young (1977)**.

5. Suckling routine

Newborn calves were suckling freely from dams up to one month old then separated from their dams and suckled twice a day, thereafter. Calves born from G1 group were divided into two sub-groups G11 (which suckled natural from their dams), while C12 (which artificial reared on a mixture of 50% natural milk and 50% reconstituent cattle milk powder) on the other hand calves born to both groups G2 and G3 dams were suckled artificial reared on the same milk mixture like of that G12 calves. Calves of different feed restriction groups and regardless of type of rearing were weaned late at 6 months old age.

6. Milk preparation for artificial rearing

Cattle milk powder used in artificial rearing was prepared by dissolving one kg of cow milk powder in 8 kg of warm water (50 °C) (1:8 dilution rate) and mixed well, then cooled to about 37°C and mixed well with camel milk with ratio 1:1. The milk was given to calves in 1 liter nursing nipples bottle. Calves were adapted to consume daily of this mixture until weaning. New-Zealand Cow milk powder used in artificial rearing of newborn calves consisted of 2.8% moisture, 24.0% protein, 28.5% fat, 5.7% mineral and 39.0% lactose.

7. Statistical analysis

Data were statistically analyzed according to Statistical Analysis System (**SAS, 2006**). The differences among the means of three groups were checked by Duncan's multiple range test to test the significance of differences among means. Data of digestibility and body weight changes were analyzed according to the following model.

$$Y_{ij} = U + T_i + e_{ij}$$

Y = an observation (as Total milk yield)

U = is overall mean

T = effect of restricted feeding

e = residual error

RESULTS AND DISCUSSIONS

1- Digestion coefficients

The data of **Table (2)** showed the effect of feed restriction in Maghrebi she-camel on nutrients digestibility before and after calving and the mean value. The dry matter digestibility not affected by feed restriction. The data clearly showed that slightly insignificant decrease in DM digestibility pre-calving were recorded for G3 compared to G1 and G2 and no significant differences were recorded among three groups post-calving and the mean value. In this connection **Nagpal and Patil (2012)** found no significant differences in DM digestibility in dromedary camel which had different energy levels. While, **Filali and Guerouali (1994)** reported that DM digestibility was 56.2% of one hump camels fed on the restricted ration at maintenance energy. **Khorchani et al (1992)** reported that dry matter digestibility (DMD) ranged from 50 -60 % in the stall-feeding (intensive system) camel and that was similar to that reported by **Afaf (2007)** who found that dry matter digestibility(DMD) were ranged between 51.38 to 55.89 % for growing camel fed on restricted ration consists of 0.5 % of body weight as berseem. **Safinaze et al (2012)** found that when camel fed iso-nitrogenous rations and different levels of energy (100,120, 140 and 160 k calorie /kg^{0.75}) of dry matter digestibility (DMD) was 56.33, 62.78, 64.08, and 68.99 (%), respectively. These results are disagreement with those of **Guerouali and Wardeh (2000)** who showed that the digestibility (%) of the restricted feeding to camel at levels of 40%, 60%, 80% and 100% as dry matter was 57.9, 62.4, 63.5 and 69.6(%), respectively of diet consisted of 50% barley grain, 17% sunflower meal and 33% ground straw and they found that the Dry matter digestibility was increase in camel with the increase of intake level.

The mean values of OM and CF digestibility pre-calving period ranged from 58.5 to 60.75% and 50.7 to 53.25%, respectively with insignificant differences. While, post-partum OM digestibility there were significant ($P < 0.05$) decreased in OM digestibility in group (G3) post-partum. The values of CF digestibility post-partum and the mean values of CF pre and post-partum had no significant differences. The mean values of OM digestibility pre and post -partum showed significant ($P < 0.05$) decreased in restricted group (G3). Results revealed that restricted periods had negative effects at this level of intake on OM digestibility and no effect on CF digestibility. This in agreement with **Nagpal and Patil (2012)** who found that an increase in OM digestibility with increase the level of energy from 50 -60% and found that insignificant digestibility in CF in dairy dromedary camel. **Abdoul and Kraiem (1990)** found that apparent digestibility of DM, OM and CF were 55, 58 and 65% for dromedary camel fed on diet containing wheat straw *ad libitum* with concentrate restricted to 0.5% kg/day.

The mean values of CP, EE, and NFE digestibility in pre-partum period for three treatments groups were ranged from 47.87 to 52.95 %; 58.17 to 62.22% and 63.83 to 70.23%, respectively in **(Table, 2)**. There were insignificant differences in CP and EE digestibility among groups while, the value of NFE digestibility was significant decreased in group (G3). Post-partum digestibilities for CP, EE and NFE were ranged 50.57 – 53.8, 62.18- 62.96 and 64.69- 64.91%, respectively with insignificant differences in CP and EE digestibility while, NFE digestibility had significant ($P < 0.05$) decreased in group (G3). The mean values of CP, EE and NFE digestibilities **(Table 2)** showed the same pattern.

Results referred to restricted feeding periods had insignificant effect on CP and EE digestibility while, had significant effect on NFE digestibility and this data in agreement with **Nagpal and Patil (2012)** found that an increase in NFE with increases in energy level in dromedary dairy camel. The range of CP digestibility more than reported by **Afaf (2007)** who fed growing camel restricted ration consisted of Berseem hay at 0.5% of live body weight with *ad libitum* wheat straw and found that CP digestibility was 43.87 and 38.36 and 20.55 for periods 30, 60 and 90 days, respectively and **Abdoul and Kraiem (1990)** found that CP digestibility was 42% in dromedary camel fed on diet containing wheat straw *ad libitum* with concentrate restricted to 0.5 kg / day.

Total digestible nutrients (TDN %) values **(Table 2)** were 66.9 in Groups G1 and G2 while, G3 was 61.9 %. Digestible crude protein (DCP) pre-partum for she-camels were 8.82% for groups G1 and G2, while it was 7.88% for G3. These values were higher than those founded by **Safinaze (2012)** she found that when camels were fed iso-nitrogenous rations but different levels of energy (100,120, 140 and 160 k calorie /kg^{0.75}) during late gestation. Results obtained revealed that ration nutritive valued were 4.79% DCP and TDN 52.38% may feed to pregnant dromedary female camels during the late pregnancy.

However, Digestible crude protein (DCP) values were 8.98 % for group G1 and 8.1% for groups G2 and G3, respectively. Total nutrients digestibility (TDN %) post-partum was 67.62 for groups G1 while, group G2 and G3 were 64.05, respectively.

2- Growth performance of the Maghrebian she-camel during experimental period

Data of growth performance in term of Initial live body weight of she-camels were 502.29, 511.20 and 524.75 kg for groups G1, G2 and G3, respectively and there were insignificant differences in live body weight among groups. Before calving live body weight of she-camels were 551.38, 559.60 and 566.8kg for G1, G2 and G3 groups, respectively without significant differences.

Results in **(Table 3)** pointed out to gradual increase in LBW of she-camels during the last three months of gestation.

In the present study, body weight changes of she-camels were segmented into three stages; the first one from the start of the experiment to just before calving and the second stage was the difference in weights of she-camels pre calving and post- calving as shown in **(Table 3)**. The third stage covered changes in live body weights from start to the end of experiment **(Table 4)**. Results revealed that changes in She- camels weight from start of the experiment to the pre-calving period for groups G1, G2 and G3 were (49.09, 48.4 and 42.05kg), respectively, however differences among groups were insignificantly. These results were mainly due to that groups G1 and G2 had more DM and TDN intake than G3 before calving. In this connection **Khan et al (2002)** who carried out an experiment on crossbred cows which had a restricted concentrate and *ad libitum* roughage or *ad libitum* feeding during last terminator of pregnancy, they found that cow fed the *ad libitum* system were gained more weight significantly than of restricted feeding group.

Table 2. Effect of feed restriction in Maghrebi she-camel on nutrient digestibility before and after calving and mean value

Item	Experimental groups								
	G1		Mean	G2		Mean	G3		Mean
	Before	after		Before	After		Before	After	
DM	54.40 ^a ±0.63	56.21 ^a ±0.57	55.35 ^a ±0.61	53.54 ^a ±1.15	56.00 ^a ±0.86	54.94 ^a ±0.61	52.25 ^a ±0.66	54.07 ^a ±0.58	54.07 ^a ±0.61
OM	60.64 ^a ±0.64	60.20 ^a ±0.63	60.42 ^a ±0.36	60.75 ^a ±0.88	60.00 ^a ±0.57	60.3 ^a ±0.36	58.5 ^a ±0.57	58.85 ^b ±0.64	58.85 ^b ±0.36
CP	47.87 ^a ±2.04	50.57 ^a ±2.22	49.21 ^a ±1.64	49.35 ^a ±2.07	53.80 ^a ±1.92	51.56 ^a ±1.64	52.95 ^a ±2.99	52.89 ^a ±1.85	52.89 ^a ±1.64
CF	51.48 ^a ±1.19	55.70 ^a ±0.55	56.27 ^a ±1.1	50.71 ^a ±1.33	55.30 ^a ±1.12	53.59 ^a ±1.1	53.25 ^a ±0.96	53.10 ^a ±2.0	53.10 ^a ±1.1
EE	58.17 ^a ±3.12	62.38 ^a ±1.09	60.27 ^a ±1.11	60.22 ^a ±0.88	62.95 ^a ±1.4	61.58 ^a ±1.11	60.42 ^a ±0.64	62.18 ^a ±1.35	62.18 ^a ±1.11
NFE	69.20 ^a ±0.92	63.83 ^a ±0.9	66.51 ^{ab} ±0.58	70.23 ^a ±0.32	64.69 ^a ±1.21	67.46 ^a ±0.58	63.91 ^b ±0.84	64.91 ^b ±1.67	64.91 ^b ±0.58
TDN%	66.98	67.62		66.98	64.05		61.99	64.05	
DCP%	8.82	8.98		8.82	8.1		7.88	8.1	

- ^{a, b} Values with different superscripts within a row are significantly different (P<0.05)
- DM: dry matter, OM: Organic matter, CP: Crude protein, CF: Crude fiber, EE: Ether extract, NFE: Nitrogen free extract, TDN: Total digestible nutrients and DCP: Digestible crude protein.
- G1: No restricted period, G2: 75% restricted concentrate (30 days post-calving) and G3: 75% Restricted concentrate (30 days pre-calving and 30 days post-calving)

Table 3. Effect of different level of feeding during pregnancy on the productive performance of Maghrebi she-camels

Items	Experimental groups		
	G1	G2	G3
Average initial body weight (Kg/She-camel)	502.29 ± 12.89	511.20 ± 27.05	524.75 ± 30.25
Weight before calving (Kg/She-camel)	551.38 ± 13.48	559.60 ± 28.2	566.8 ± 31.6
Total LBW from start to Before calving (Kg/She-camel)	49.09 ± 3.54	48.4 ± 7.42	42.05 ± 8.30
Calving weight (kg /She-camel)	511.45 ± 13.0	519 ± 27.4	514.5 ± 30.68
Total weight loss before calving and calving weight (kg/ She-camel)	42.88 ± 3.57	40.6 ± 8.37	52.3 ± 7.49
Weight after calving(kg)	521.81 ± 13.54	527 ± 28.4	505 ± 31.75
Feed intake (kg DM /head/day)	11.00	11.00	9.86
Concentrate intake (kg DM/head/day)	4.54	4.54	3.40
Roughage intake (kg DM/head/day)	6.46	6.46	6.46
Calves birth weight (kg)	30.44 ± 0.87	32.8 ± 1.92	29.73 ± 2.58
Calves growth rate after 1 st month	0.326 ^a ± 0.56	0.247 ^{ab} ± 0.2	0.176 ^b ± 0.09

- ^{a, b} Values with different superscripts within a row are significantly different (P<0.05)
 - G1: No restricted feeding, G2: 75% restricted concentrate for, 30 days post-partum and G3: 60 days 75% restricted concentrate (30 days pre and 30 days post-partum)
- LBW (live body weight), DM (dry matter)

On the other hand, live body weight changes pre calving to post- calving period showed that there was a great loss in G3 (52.3 kg) than the two other groups G1 (42.88 kg) and G2 (40.6 kg), respectively without significant differences (Table 3). This result was in agreement with **Safinaze et al (2012)** who found that when camels were fed iso-nitrogenous rations, but with different levels of energy (100,120, 140 and 160 k calorie /kg^{0.75}), the lowest loss in calving weight was in the group which had the higher energy level. Results revealed that calving live body weight indicated insignificant differences among groups.

Changes in live body weights from start to end of experiment are presented in **(Table 4)**. As shown G1 and G2 groups indicated higher live body weight (45.98 kg) and (35.2 kg), respectively from the start to the end of the experiment, while there was loss in weight by about (-3.5kg) for G3 during the same period. The difference among groups were significant (P<0.05). As shown the greatest body weight loss was recorded for G3 which received 75% of the daily recommended requirement for one month before and another one month after calving, in compare with both of G2 which had 75% of recommended requirement one month after calving and G1 which received 100% of the daily requirement .Similar results were reported by **Khan et al (2002)** who found that there was significant difference in cows body weight from the initial to post calving, where cows in the restricted group lost weight, but the *ad libitum* group gained weight.

Feed intake pre-calving as DMI were 11.00 kg for G1 and G2 groups, while she-camels received only 9.87 kg DMI / she-camel/ day, **(Table 3)**. The daily intake in the present study was nearly similar to recommendation of Indian Council of Agriculture Research (2013) which was about 10.79 kg/DMI/day for pregnant camels.

Values of dry matter intake (DMI) during post-calving period were 11.41 for G1 and 10.26 kg /day for G2 and G3 groups **(Table 4)** and this is nearly similar to the recommendation of Indian Council of Agriculture Research for lactating camels (2013) which was 11.66 kg DMI head/ day.

Birth weight values of camel calves were 30.44, 32.8 and 29.73 kg for G1, G2 and G3 groups, respectively represented in **(Table 3, Fig. 1)**. As shown there was insignificant effect of restricted feeding periods on camel calves birth weight. These results are in agreement with those of **Khan et al. (2002)** who pointed out insignificantly differ-

ences in calves birth weight between restricted animals and *ad libitum* group. Similarly **Anthony et al (1986)** observed also insignificantly effect of low or high plane pre-partum nutrition on calf birth weight, however high plane calves were shown to be slightly heavier than the low plane calves and **Safinaze (2012)** who found that when camel fed iso-nitrogenous rations and different levels of energy (100,120, 140 and 160 k calorie /kg^{0.75}), there was no significant effect of different level of energy during late pregnancy in dromedary camel on birth weight.

Milk yield

There were insignificant effect of pre-calving and post-calving restricted feeding periods neither on total milk yield nor daily milk yield during seven months lactation length. Total milk yield values in seven months were 790.05, 697.67 and 708.56 kg, respectively for groups G1, G2 and G3, respectively, while daily milk yield valued were 3.78, 3.32 and 3.4 kg /head/ day without significant difference among groups (Table 4). This result disagreed with **Khan et al (2002)** founded cows on the restricted feeding produced little more milk (3.06 lit/cow/day), than that of the cows on *ad. Libitum* feeding (2.84 lit/cow/day) during lactation period. Monthly milk yield during seven months are presented in **(Fig. 2)**. The peak of milk yield lies in the third month in G1 and G2 groups while, it delayed in the fourth month in G3 group. Average daily milk in the present study nearly was to that range reported by **El-Bahey (1982)** who found that daily milk yield in Egypt ranged between 3.5-4.5 kg/ day.

Reproductive performance of the dromedary she-camels

Time required from calving to first heat and time required form calving to conception and were (28.3 and 65.91), (30.8 and 71) and (30.2 and 90.8) days for G1, G2 and G3 groups, respectively **(Table 4)**. There was no significant differences in the time required to first heat among groups, while there were significant(P<0.05) differences in time required to conception (days), whereas the third group G3 exhibited more longer period to be conceived. It was suggested that, such longer period for G3 to be conceived, was mainly related to the lower nutritional feeding of such group. This was accordance with **Musa et al (2006)** who found that time from delivery to first heat in *dromedary camel*

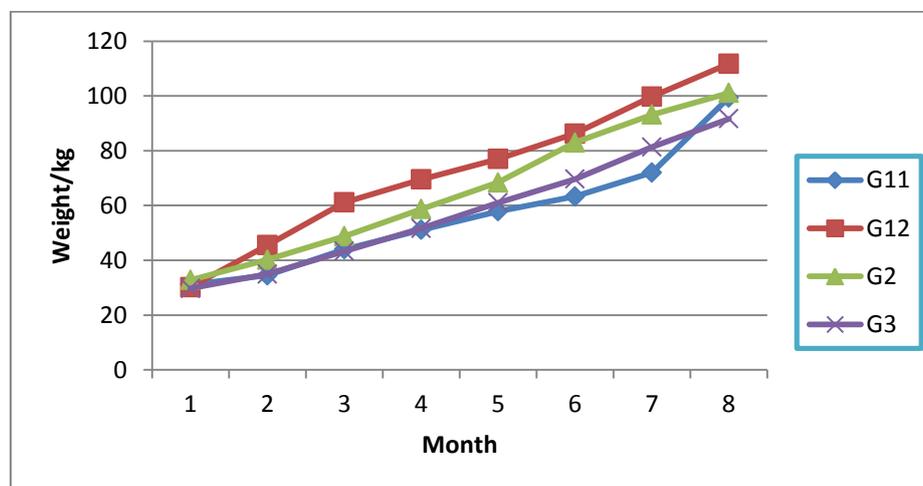


Fig. 1. Weight of the Maghrebi camel calves during experimental period

Table 4. Effect of different of restricted feeding periods on lactation and reproductive performance of Maghrabi she-camel

Items	Experimental groups		
	G1	G2	G3
Average weight at the end of lactation (kg)	548.27 ± 20.8	546.4 ± 24.01	521.25 ± 10.02
LBW changes , (Kg) (From start to end of experiment)	45.98 ^a ± 6.29	35.2 ^a ± 14.33	-3.5 ^b ± 9.52
Daily milk yield /She-camel (kg)	3.78	3.32	3.40
Total milk yield in seven months (Kg)	790.05 ± 47.53	697.67 ± 31.31	708.56 ± 58.39
DMI (day/she-camel) kg	11.41	10.26	10.26
Roughage intake (DM/day/she-camel) kg	6.42	6.52	6.52
Concentrate intake (DM/day/she-camel)kg	4.99	3.74	3.74
Time required to first heat (days)	28.3 ± 3.5	30.8 ± 1.7	30.2 ± 2.4
Time required to conception (days)	65.91 ^a ± 17.9	71 ^{ab} ± 20.7	90.8 ^b ± 21.5

• ^{a, b} Values with different superscripts within a row are significantly different (P<0.05)

G1: no restricted period, G2: 75% restricted concentrate, 30 days post-calving and G3: 75% restricted concentrate 60 days (30 days pre-calving and 30 days post-calving)

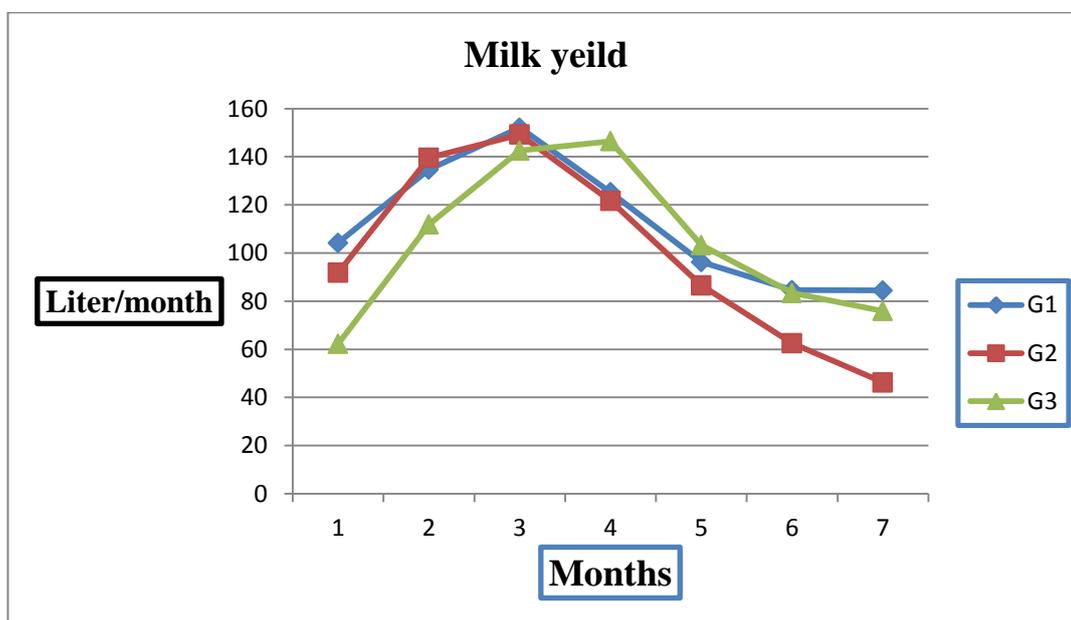


Fig. 2. Milk yield during experimental period

ranged from 30-45 days depending on the nutritional status of animal, while Khan et al (2002) didn't found any significantly effect of nutritional treatment (restriction or *ad libitum*) on the reproductive performance.

General conclusion and recommendation

On the light of present study, It could be concluded that, plane of restricted feeding 75% of daily feed allowances for one month during pre or post-calving didn't lead to any negative effect on the productive performance of she-camel where, there were no effect on live body weight, total milk yield, birth weight of calves and while, reproductive performances of the Maghrebian she-camel there were no effect in time required to first heat but slightly better in time required from calving to conception in group fed on 100% requirements than other restricted groups. Considerably, all these observation, we can ably this plane of feeding on dromedary she-camel before or after calving, during shortage of feed without any adverse effect of productive or reproductive performance.

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